Optimization of analytical SEM for ceramic energy materials research

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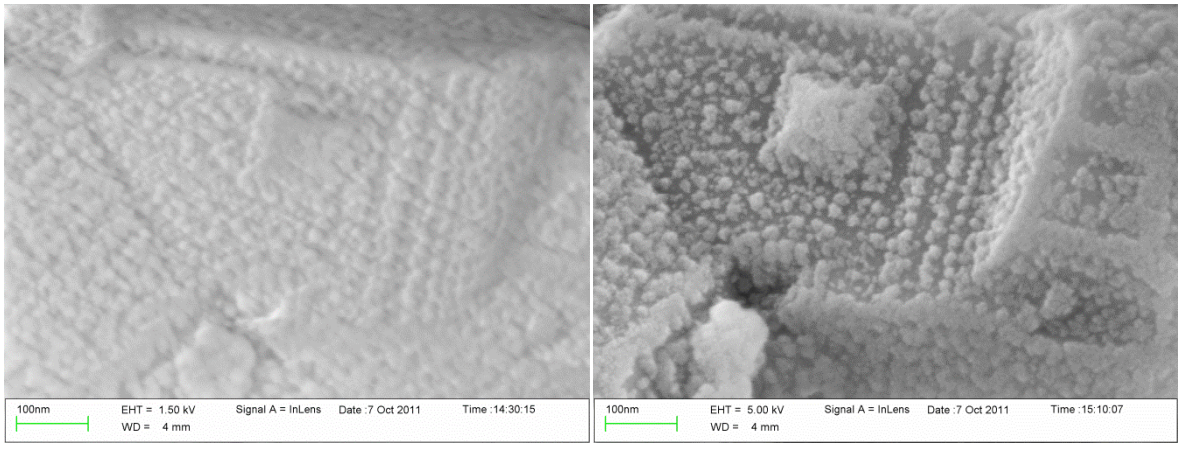
Abstract

Resolution on the nanometer scale is often required in order to image the microstructure of high temperature ceramic devices such as solid oxide fuel cells (SOFC), solid oxide electrolysis cells (SOEC), exhaust cleaning membranes etc. (often consisting of porous ceramics with nanoparticles), and to elucidate the subtle changes occurring during their degradation. Challenges and solutions towards optimization of HRSEM imaging involving issues with choice of aperture, voltage, carbon coating or not, sample contamination, charging etc. will be addressed. Other challenges for the analytical SEM for ceramic energy materials research are issues concerning quantification of grain size, phase distribution, phase percolation in porous composite networks etc.. Furthermore a method for higher spatial resolution in the chemical analysis by EDS performed in a scanning electron microscope will be illustrated.



SEM images illustrating the effect of acceleration voltage (1.5 kV - left; 5 kV - right) on the imaging of ceramics with nanoparticles.